USB Programmable, DIN Rail Mount Thin Transmitter

Model TT337-0700
4-Wire Transmitter, DC Voltage Input
Universal Current & Voltage Output

USER'S MANUAL

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8500-938C

Table of Contents

GETTING STARTED

DESCRIPTION 5
- Key Features 5
- Application 5
- Mechanical Dimensions 6
- DIN Rail Mounting & Removal 6

ELECTRICAL CONNECTIONS 7
- Sensor Input Connections 8
- Output Connections 9
- Power Connections 10
- Optional Bus Power Connections 11
- Earth Ground Connections 12
- USB Connections 13

CONFIGURATION SOFTWARE 14
- Quick Overview 14

TECHNICAL REFERENCE

OPERATION STEP-BY-STEP 16
- Connections 16
- Configuration 17
- Calibration (Optional) 20

BLOCK DIAGRAM 22
- How It Works 22

TROUBLESHOOTING 23
- Diagnostics Table 23
- Service & Repair Assistance 24

ACCESSORIES 25
- Software Interface Package 25
- USB Isolator 25
- USB A-B Cable 25
- USB A-mini B Cable 25

SPECIFICATIONS 26
- Model Number 26
- Input 26
- Output 28
- USB Interface 29
- Power 30
- Enclosure & Physical 30
- Environmental 30
- Agency Approvals 31
- Reliability Prediction 31
- Configuration Controls 31

DESCRIPTION 5
- Key Features 5
- Application 5
- Mechanical Dimensions 6
- DIN Rail Mounting & Removal 6

ELECTRICAL CONNECTIONS 7
- 7
- Sensor Input Connections 8
- Output Connections 9
- Power Connections 10
- Optional Bus Power Connections 11
- Earth Ground Connections 12
- USB Connections 13

CONFIGURATION SOFTWARE 14
- Quick Overview 14

OPERATION STEP-BY-STEP 16
- Connections 16
- Configuration 17
- Calibration (Optional) 20

BLOCK DIAGRAM 22
- How It Works 22

TROUBLESHOOTING 23
- Diagnostics Table 23
- Service & Repair Assistance 24

ACCESSORIES 25

Software Interface Package **25**
USB Isolator **25**
USB A-B Cable **25**
USB A-mini B Cable **25**

SPECIFICATIONS 26

Model Number **26**
Input **26**
Output **28**
USB Interface **29**
Power **30**
Enclosure & Physical **30**
Environmental **30**
Agency Approvals **31**
Reliability Prediction **31**
Configuration Controls **31**

REVISION HISTORY 32

1

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IMPORTANT SAFETY CONSIDERATIONS

You must consider the possible negative effects of power, wiring, component, sensor, or software failure in the design of any type of control or monitoring system. This is very important where property loss or human life is involved. It is important that you perform satisfactory overall system design and it is agreed between you and Acromag, that this is your responsibility.

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GETTING STARTED

DESCRIPTION

Symbols on equipment:

Means "Refer to User's Manual (this manual) for additional information".

The TT337-0700 is an ANSI/ISA Type IV transmitter designed to interface with DC voltage signals (±1V, ±5V, ±10V), isolate the input signal, and modulate a DC current or DC voltage signal at its output. This unit is configured and calibrated using configuration software and a USB connection to Windows-based PC's (Windows XP and later versions only). The unit provides an adjustable input range, selectable output range for voltage or current, three-way isolation, and a variable input filter.

Key Features

- **Digitally configured and calibrated w/ Windows software via USB.**
- **Thin 17.5mm wide enclosure for high-density DIN-rail mounting.**
- **High measurement accuracy and linearity with 16-bit conversion.**
- **Adjustable input range and selectable output ranges.**
- **DC Voltage Input for voltage ranges up to ±1V.**
- **DC Voltage Input for voltage ranges up to ±10V.**
- **Universal Output for ±10V, ±5V, 0-10V, 0-5V, ±20mA, 0-20mA, and 4-20mA.**
- **Output drives DC current or DC voltage without rewiring.**
- **Normal or Reverse Acting output.**
- **Variable Digital Input Filter adjustment.**
- **Wide-range DC power input from 12-32V.**
- **Bussed Power and/or Redundant Power Ready.**
- **Wide ambient temperature operation.**
- **Thoroughly Tested and Hardened For Harsh Environments.**
- **CE Approved.**
- **UL/cUL Class 1, Division 2 Approved.**

Application

For additional information on these devices and related topics, please visit our web site at www.acromag.com.

This transmitter is designed for high-density mounting on T-type DIN rails. Units may be mounted side-by-side on 0.7 inch (17.5mm) centers. It supports 12-32V DC power via terminals on the unit, or optionally via power wired to its DIN-rail bus connector.

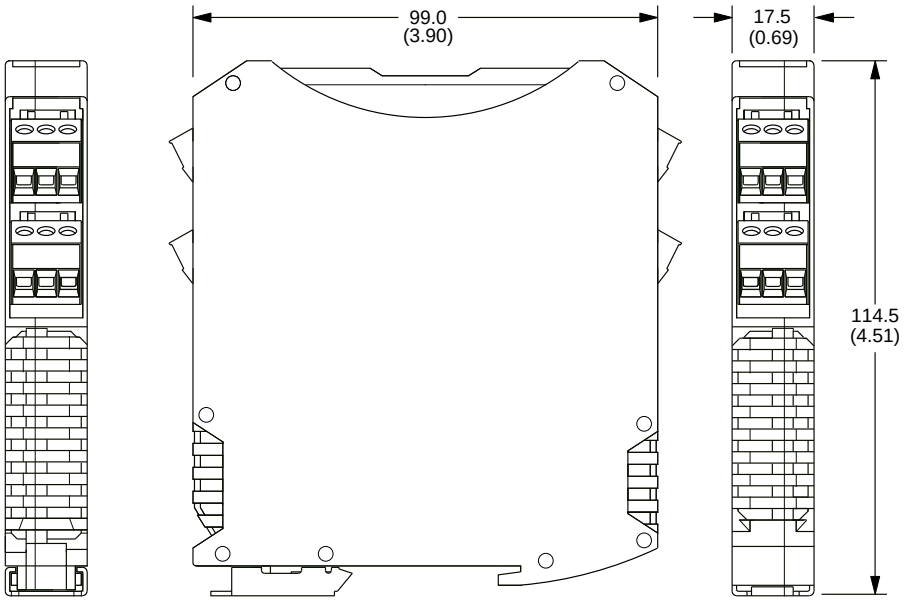
This model isolates a DC voltage input signal and can mate with grounded or non-grounded sensors.

The universal output signal is isolated from input and power and will drive current or voltage signals for the ranges ±20mA, 0-20mA, 4-20mA, ±10V, ±5V, 0-10V, and 0-5V. The output of this transmitter is very unique in that it can drive either current or voltage under digital control using the same two output terminals (only the load must be adjusted).

Mechanical Dimensions

Units may be mounted to 35mm "T" type DIN rail (35mm, type EN50022), and side-by-side on 0.7-inch centers.

WARNING: *IEC Safety Standards may require that this device be mounted within an approved metal enclosure or sub-system, particularly for applications with exposure to voltages greater than or equal to 75VDC or 50VAC.*

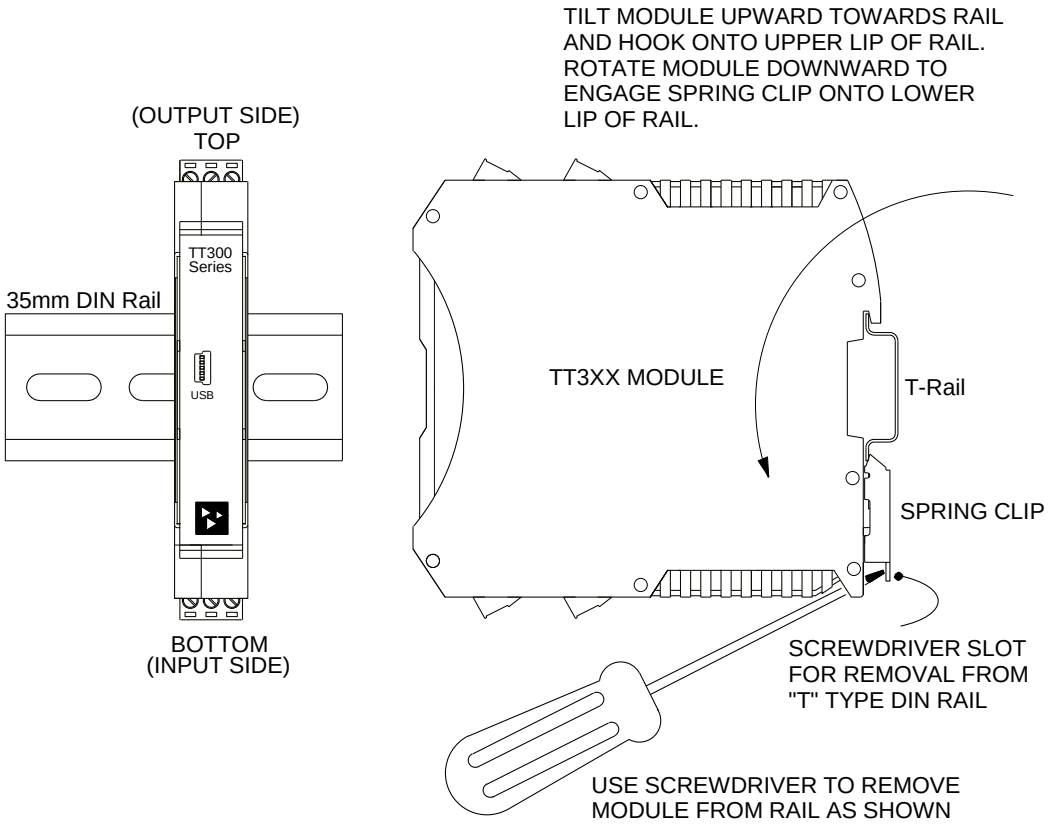


DIMENSIONS ARE IN MILLIMETERS (INCHES)

DIN Rail Mounting & Removal

Refer to the following figure for attaching and removing a unit from the DIN rail. A spring loaded DIN clip is located on the input side bottom. The opposite rounded edge at the bottom of the output side allows you to tilt the unit upward to lift it from the rail while prying the spring clip back with a screwdriver. To attach the module to T-type DIN rail, angle the top of the unit towards the rail and place the top groove of the module over the upper lip of the DIN rail. Firmly push the unit downward towards the rail until it snaps into place. To remove it from the DIN rail, first separate the input terminal blocks from the bottom side of the module to create a clearance to the DIN mounting area. You can use a screwdriver to pry the pluggable terminals out of their sockets. Next, while holding the module in place from above, insert a screwdriver into the lower path of the bottom of the module to the DIN rail clip and use it as a lever to force the DIN rail spring clip down while pulling the bottom of the module outward until it disengages from the rail. Then simply lift it from the rail.

TT3XX MODULE DIN RAIL MOUNTING AND REMOVAL


TILT MODULE UPWARD TOWARDS RAIL AND HOOK ONTO UPPER LIP OF RAIL. ROTATE MODULE DOWNWARD TO ENGAGE SPRING CLIP ONTO LOWER LIP OF RAIL.
(OUTPUT SIDE)
TOP
TT300 Series
35mm DIN Rail
USB
BOTTOM
(INPUT SIDE)
TT3XX MODULE
T-Rail
SPRING CLIP
SCREWDRIVER SLOT FOR REMOVAL FROM "T" TYPE DIN RAIL
USE SCREWDRIVER TO REMOVE MODULE FROM RAIL AS SHOWN

ELECTRICAL CONNECTIONS

WARNING – EXPLOSION HAZARD – Do not disconnect equipment unless power has been removed or the area is known to be non-hazardous.
WARNING – EXPLOSION HAZARD – Substitution of any components may impair suitability for Class I, Division 2.
WARNING – EXPLOSION HAZARD – The area must be known to be non-hazardous before servicing/replacing the unit and before installing.

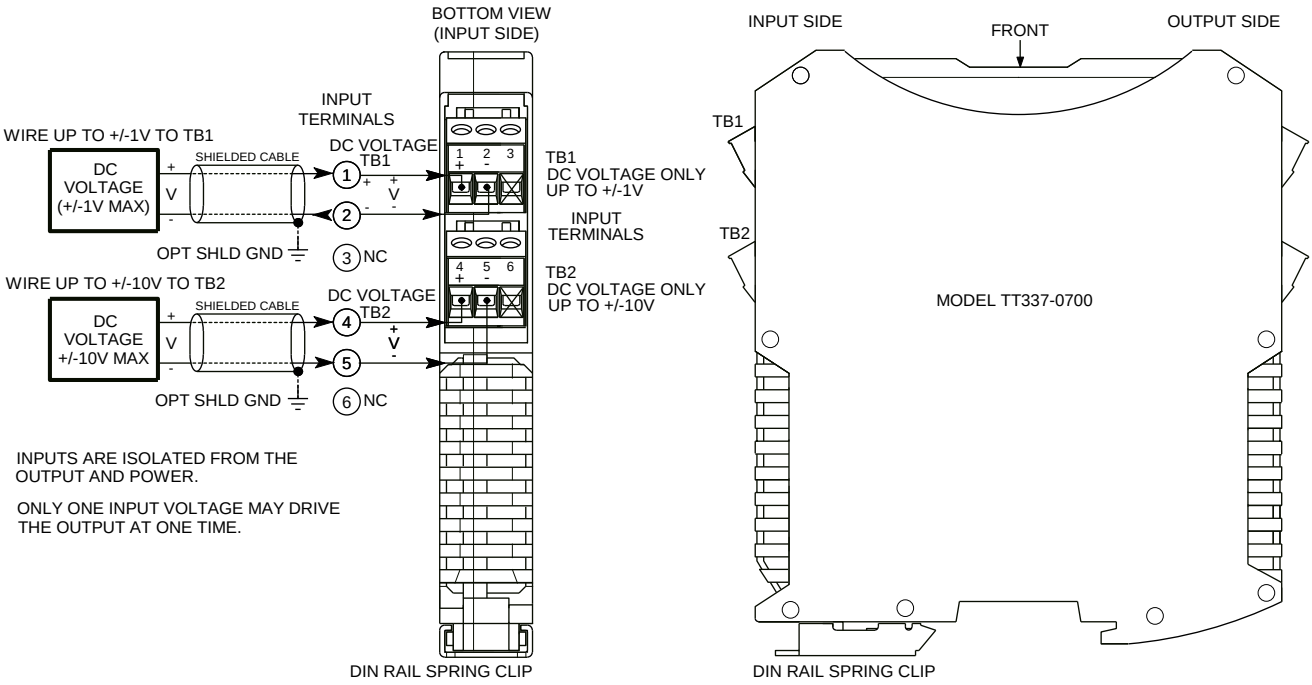
Wire terminals can accommodate 14-26 AWG solid or stranded wire. Input wiring may be shielded or unshielded type. Ideally, output wires should be twisted pair, or shielded twisted pair. Terminals are pluggable and can be removed from their sockets by prying outward from the top with a flat-head screwdriver blade. This model allows DC voltage up to ±1V at TB1, and ±10V at TB2, but only one input may drive the output. Strip back wire insulation 0.25-inch on each lead and insert the wire ends into the cage clamp connector of the terminal block. Use a screwdriver to tighten the screw by turning it in a clockwise direction to secure the wire (0.5-0.6Nm torque). Since common mode voltages can exist on signal wiring, adequate wire insulation should be used and proper wiring practices followed. As a rule, output wires are normally separated from input wiring for safety, as well as for low noise pickup.

Sensor Input Connections

Sensor wires are wired directly to transmitter input terminals at the bottom of the module (the spring-loaded DIN clip side), as shown in the connection drawing below. Observe proper polarity when making input connections.

- **The Transmitter input signal is isolated from the output**.
- **Up to ±1V DC Voltage is wired to the upper terminal block (TB1)**.
- **Up to ±10V DC Voltage is wired to the lower terminal block (TB2)**.
- **Inputs are polarized "+" and "-".** The positive input is on the left and labeled "+", and the negative input is to its right. Observe proper polarity. See connection figure below.
- **Only one input may drive the output at one time**.

MODEL TT337-0700 INPUT SIGNAL WIRING

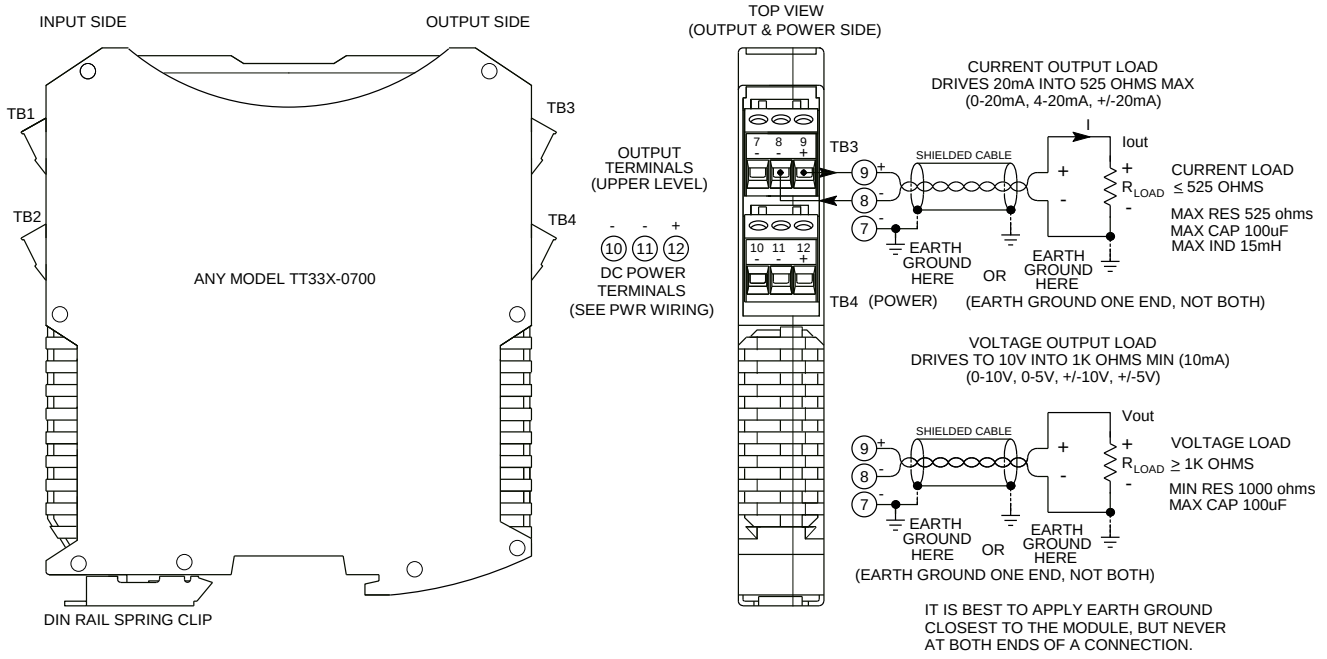


Output Connections
(DC Current or Voltage)

This transmitter is an ANSI/ISA Type 4 in which the unit's power is separate from the input and output circuits.

- Output connections are polarized. Current is output from Output+ and returned to Output-. Voltage output is positive at Output+.
- Variations in load resistance have negligible effect on output accuracy, as long as load limits are respected with respect to output type (see below).

MODEL TT33X-0700 OUTPUT WIRING
OUTPUT WIRED FOR DC CURRENT OR VOLTAGE



Observe proper polarity. Note that twisted-pair wiring is often used to connect the longest distance between the field transmitter's output and the remote load as shown above. Additionally, shielded twisted pair wiring is recommended for best results. An output connection to earth ground will help protect the circuit from damage in noisy environments.

WARNING: For compliance to applicable safety and performance standards, the use of twisted pair output wiring is recommended. Failure to adhere to sound wiring and grounding practices as instructed may compromise safety, performance, and possibly damage the unit.

Output Connections… (DC Current or Voltage)

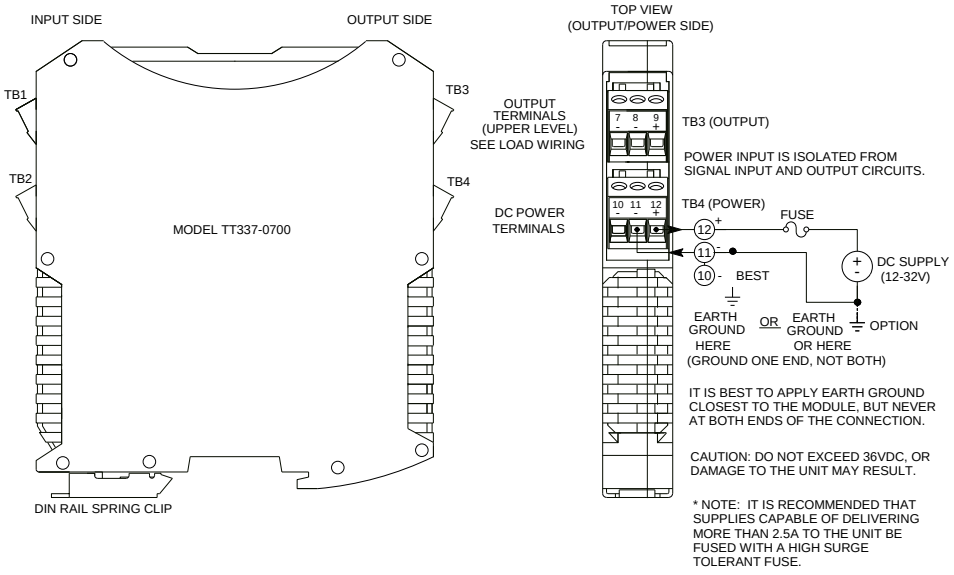
TIP - Ripple & Noise: Additional filtering placed at the output load can help reduce 60Hz/120Hz ripple often present in industrial environments. For large 60Hz supply ripple, connect an external 1uF or larger capacitor directly across the load to reduce excessive ripple. For sensitive applications with high-speed acquisition at the load, high frequency noise may be reduced significantly by placing a 0.1uF capacitor directly across the load, and as close to the load as possible.

Power Connections

The unit is powered from 12-32V DC (36V DC peak) by connecting power as shown below. This transmitter can be optionally powered (or redundantly powered) via the DIN rail bus when coupled to the DIN rail bus connector (Acromag Model 1005-063) and a bus terminal block (Acromag 1005-220 or 1005-221). This optional method can also allow several modules to share a single power supply without wiring to each individually.

- Power connections are isolated from the input and output. The supply voltage should be from 12-32V DC. This voltage must never exceed 36V DC peak, or damage to the unit may result.
- Variations in power supply voltage between the minimum required and 32V maximum, has negligible effect on transmitter accuracy.
- Note the placement of earth ground at power. The power cable shield and DC- should ideally be grounded closest to the module. The input and output circuit commons are capacitively coupled to earth ground at DC- through high-voltage isolation capacitors, offering some protection if their circuits happen to float (not recommended).

MODEL TT337-0700 POWER WIRING
UNIT IS DC-POWERED ONLY AT 12 TO 32VDC.


INPUT SIDE
OUTPUT SIDE
TB1
TB2
TB3
TB4
MODEL TT337-0700
DIN RAIL SPRING CLIP
OUTPUT TERMINALS (UPPER LEVEL) SEE LOAD WIRING
DC POWER TERMINALS
TOP VIEW (OUTPUT/POWER SIDE)
7 8 9
TB3 (OUTPUT)
POWER INPUT IS ISOLATED FROM SIGNAL INPUT AND OUTPUT CIRCUITS.
10 11 12
TB4 (POWER)
FUSE
12
11
10
BEST
DC SUPPLY (12-32V)
EARTH GROUND HERE
OR
EARTH GROUND OR HERE
OPTION
(GROUND ONE END, NOT BOTH)
IT IS BEST TO APPLY EARTH GROUND CLOSEST TO THE MODULE, BUT NEVER AT BOTH ENDS OF THE CONNECTION.
CAUTION: DO NOT EXCEED 36VDC, OR DAMAGE TO THE UNIT MAY RESULT.
* NOTE: IT IS RECOMMENDED THAT SUPPLIES CAPABLE OF DELIVERING MORE THAN 2.5A TO THE UNIT BE FUSED WITH A HIGH SURGE TOLERANT FUSE.

Power Connections…

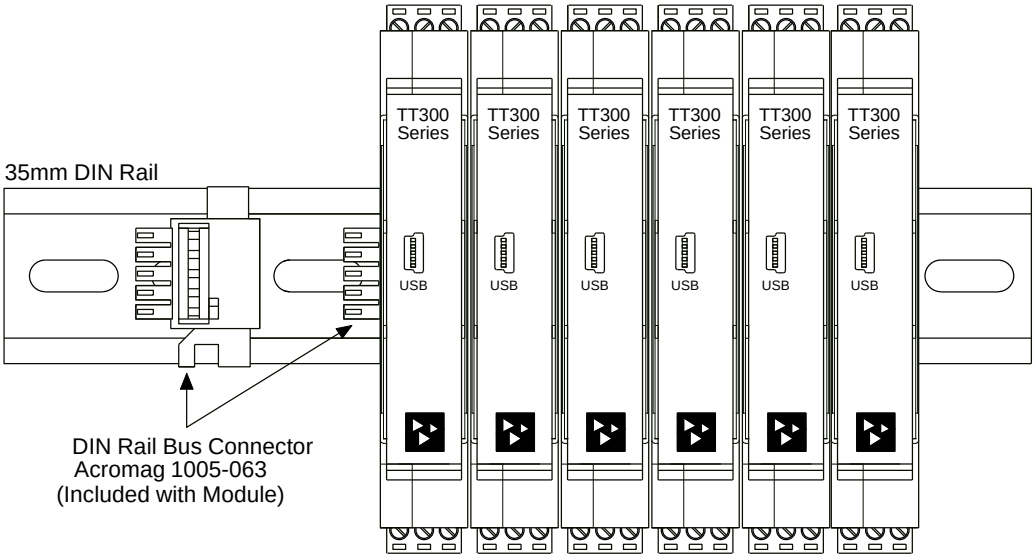
CAUTION: Risk of Electric Shock – More than one disconnect switch may be required to de-energize this equipment before servicing.

IMPORTANT – External Fuse: If unit is powered from a supply capable of delivering more than 2.5A to the unit, it is recommended that this current be limited via a high surge tolerant fuse rated for a maximum current of 2A or less (for example, see Bel Fuse MJS or RJS fuse types).

Optional Bus Power Connections

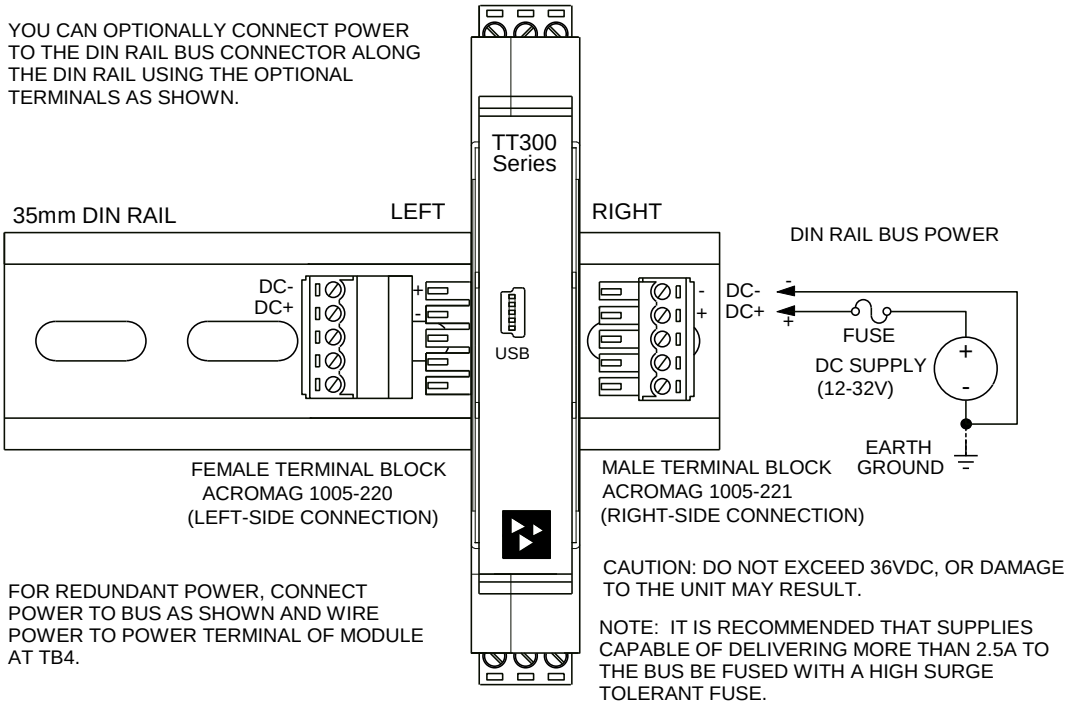
Power is normally connected to the TB4 power terminals of the unit as shown on the previous page. However, this transmitter is equipped to be optionally or redundantly powered via its DIN rail bus connector provided (Acromag 1005-063), when also mated to an optional plug-in terminal block (Acromag 1005-220 or 1005-221, depending on side of entry). Power input via the bus connector terminal is diode-coupled to the same point in the circuit as unit power connected at power terminal TB4. You can elect to power multiple units by snapping them together along the DIN rail bus, then using a mating terminal block (select a Left or Right side connector, see figure of next page). While the intent of the bus power connector is to allow several units to conveniently share a single supply, you may also use the bus power connector to redundantly power units (with local power also applied at TB4), allowing a backup supply to maintain power to the unit(s) should the main supply at TB4 fail.

Your unit comes equipped with the bus connector 1005-063 shown below. This connector allows units to snap together, side-by-side, along the DIN rail and share these connections. But to complete connection to power, you will additionally need an optional plug-in bus terminal block (Acromag 1005-220 for left-side, or 1005-221 for right-side connections). Refer to the figure of the following page which shows how to wire power to the optional bus connector using these connectors.



Optional Bus Power Connections…

The figure below shows how to wire power to the optional bus terminal block when mated to the bus connector. Note that power is wired to the rightmost bus terminals on the right, or the left-most terminals on the left. Observe proper polarity.


YOU CAN OPTIONALLY CONNECT POWER TO THE DIN RAIL BUS CONNECTOR ALONG THE DIN RAIL USING THE OPTIONAL TERMINALS AS SHOWN.
TT300 Series
35mm DIN RAIL
LEFT
RIGHT
DIN RAIL BUS POWER
DC-
DC+
USB
FUSE
DC SUPPLY (12-32V)
EARTH GROUND
FEMALE TERMINAL BLOCK ACROMAG 1005-220 (LEFT-SIDE CONNECTION)
MALE TERMINAL BLOCK ACROMAG 1005-221 (RIGHT-SIDE CONNECTION)
FOR REDUNDANT POWER, CONNECT POWER TO BUS AS SHOWN AND WIRE POWER TO POWER TERMINAL OF MODULE AT TB4.
CAUTION: DO NOT EXCEED 36VDC, OR DAMAGE TO THE UNIT MAY RESULT.
NOTE: IT IS RECOMMENDED THAT SUPPLIES CAPABLE OF DELIVERING MORE THAN 2.5A TO THE BUS BE FUSED WITH A HIGH SURGE TOLERANT FUSE.

Earth Ground Connections

The unit housing is plastic and does not require an earth ground connection. If the module is mounted in a metal housing, an earth ground wire connection to the metal housing's ground terminal (green screw) is usually required using suitable wire per applicable codes. Circuits wired to input, output, and power should be earth grounded as reflected in the connection diagrams. The ground connections noted are recommended for best results and help protect the unit by giving it a low impedance path to ground for shunting destructive transient energy. See the Electrical Connections Drawings for Input, Output, and Power, and note the position of earth ground. Earth ground should be applied at the input power minus terminal (DC-). The input and output circuit returns are additionally shunted to earth ground applied at power minus via internal isolation capacitors.

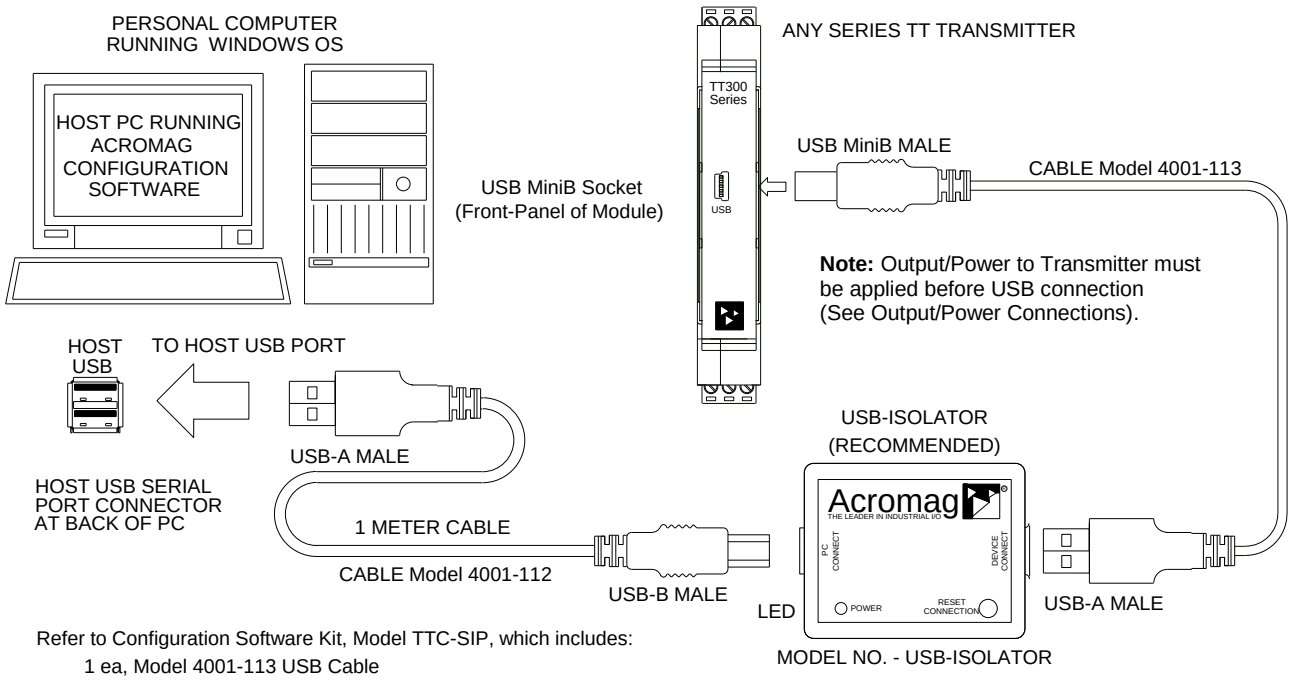
- Avoid inadvertent connections to earth ground at other points than those indicated, as this could drive ground loops and negatively affect operation.
- A USB isolator is recommended when configuring or calibrating a unit to avoid the ground loop that occurs if your input is also earth grounded (A PC commonly earth grounds its USB port and this makes contact with both the USB signal and shield ground which is held in common to the input circuit ground of this transmitter).

USB Connections

This transmitter is configured and calibrated via configuration software that runs on a Windows-based PC connected to the unit via USB (Windows XP or later required). Refer to the following drawing to connect your PC or laptop to the transmitter for the purpose of reconfiguration and calibration using this software.

TT SERIES USB TRANSMITTER CONNECTIONS

USED FOR CONFIGURATION AND CALIBRATION OF THE TRANSMITTER IN A SAFE OR ORDINARY LOCATION



Refer to Configuration Software Kit, Model TTC-SIP, which includes:

- 1 ea, Model 4001-113 USB Cable
- 1 ea, Model 4001-112 USB Cable
- 1 ea, Model USB-ISOLATOR
- 1 ea, Configuration Software CDROM 5040-944

WARNING: The intent of mating USB with this transmitter is so that it can be conveniently setup and calibrated in a safe area, then installed in the field which may be in a hazardous area. Do not attempt to connect a PC or laptop to this unit while installed in a hazardous area, as USB energy levels could ignite explosive gases or particles in the air.

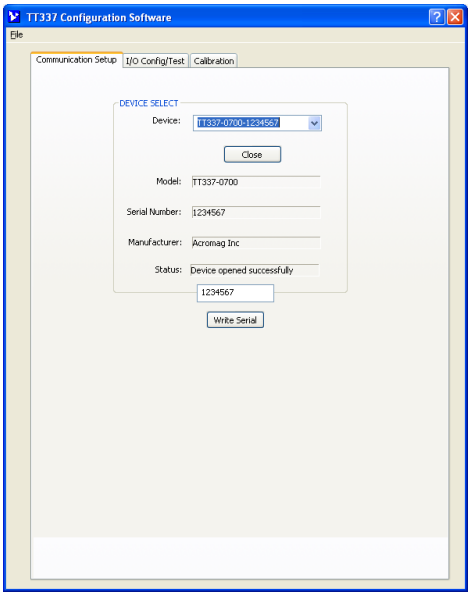
- USB Signal Isolation is recommended and required when connected to a grounded input – Input and USB connections are isolated from the output and power of this model. USB Isolation is recommended for safety and noise suppression reasons, but required when the input signal happens to be grounded. You may use Acromag model USB-ISOLATOR to isolate your USB port, or you can optionally use another USB signal isolator that supports USB Full Speed operation (12Mbps).

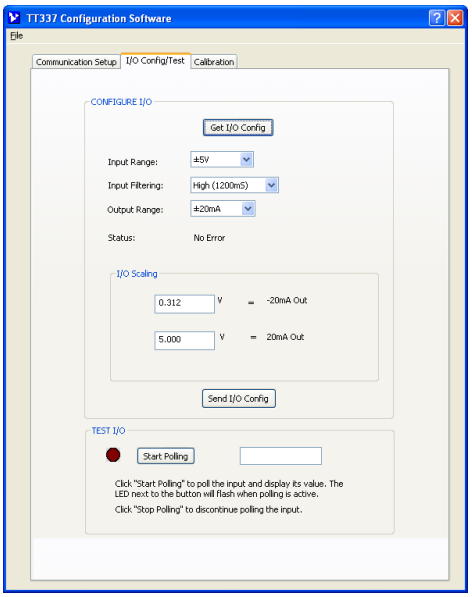
IMPORTANT: USB logic signals to the transmitter are referenced to the potential of the transmitter's input circuit ground. This ground is held in common with USB ground and USB cable shield ground. Thus, an isolator is required when the input signal is grounded and the unit is connected to the USB port of an earth-grounded PC. You could avoid the use of an isolator if a battery powered laptop was instead used to connect to the transmitter, and the laptop had no other earth ground connection, either directly or indirectly via a connected peripheral.

CONFIGURATION SOFTWARE

Quick Overview

*Click **"Open"** to connect to the TT337-0700 and your screen will look similar to the following:*





This transmitter can only be configured and calibrated via its Configuration Software and a USB connection to your PC or laptop. The configuration software can be downloaded free of charge from our web site at www.acromag.com. This software is also included on a CDROM bundled with the Configuration Kit TTC-SIP (see Accessories section). For this model, look for the program TT337Config.exe. This software is compatible with XP or later versions of the Windows operating system.

The initial configuration software screen for this model is shown at left. Configuration information is divided across three pages (tabs) as follows: Communication Setup, I/O Config/Test, and Calibration. A short description of each of these configuration pages follows:

Communication Setup (First Connect to Unit Here)

- Select from connected transmitters and Open/Close communication with them.
- Display the Model, Serial Number, and Manufacturer of the connected transmitter and report the status of communication with it.

This section is used to select a connected transmitter, and open/close communication with it. Device connection Status is also indicated here, along with the connected transmitter's ID info (Product Name/serial, Manufacturer, & Serial Number).

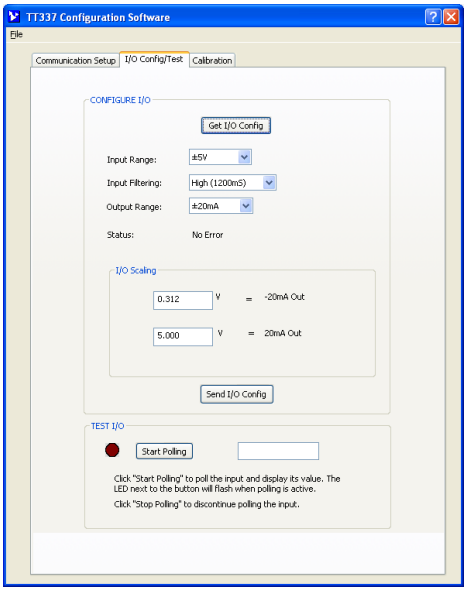
I/O Config/Test (Configure and/or Test the Unit Here)

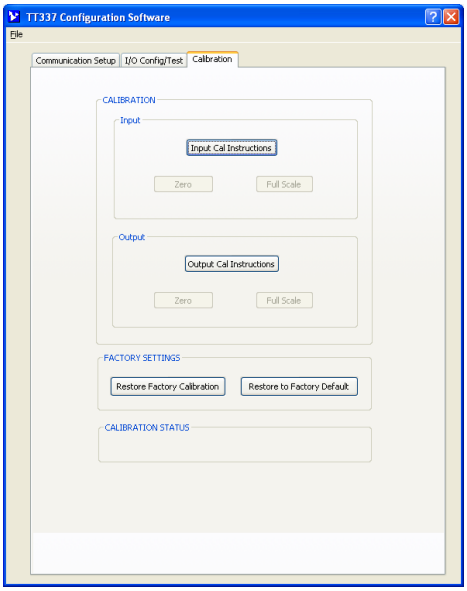
- You can click the **[Get I/O Config]** button to retrieve the I/O configuration of the currently connected transmitter.
- Select input type/range (±10V, ±5V, ±1V, 0-1V, 0-5V, and 0-10V). Note that ranges up to ±1V only apply to inputs wired at TB1, ranges wider than ±1V must be wired to TB2.
- Set the level of Input Filtering to High, Medium, Low, or None (No digital filtering). The corresponding I/O response time varies with the filter selection and is indicated in parenthesis next to your selection.
- Set Output Range to ±10V, ±5V, 0-5V, 0-10V, ±20mA, 0-20mA, or 4-20mA.
- View the unit's configuration message status in the Status field.
- Use the I/O Scaling fields to specify the specific input range endpoints that are to correspond to the output range zero and full-scale endpoints.
- Last, after making I/O changes, send your settings to the unit by clicking the **[Send I/O Config]** button and follow the on-screen prompts.

For detailed configuration and calibration procedures, see the Operation Step-By-Step section of the Technical Reference on page 15 of this manual.

Quick Overview…

HELP – You can press F1 for Help on a selected or highlighted field or control. You can also click the [?] button in the upper-right hand corner of the screen and then click again to point to a field or control to get a Help message pertaining to the item you pointed to.





Test I/O (Optional, Verify Unit Operation Here)

After making I/O configuration changes, you can use the I/O Test controls to start/stop polling the input channel, as required to check your input readings.

- Click the **[Start Polling]** button to periodically read your input channel and validate its operation. Click "Stop Polling" to stop polling the input channel. Note the simulated red lamp next to the button flashes slowly when the software is polling the input channel.

CALIBRATION (Calibrate the Input and/or Output if Needed)

This unit has already been factory calibrated. If you encounter excessive error, you can choose to click the Calibration tab to display the Calibration control page as shown in the second screen shown at left.

To calibrate the Input or Output stage of this model, simply click the respective "Cal Instructions" button and follow the on-screen prompts.

Input…

Before attempting calibration, first set the Input Range to calibrate from the I/O Config/Test page and be sure to click the **[Send I/O Config]** button. On the Calibration page, click the **[Input Cal Instructions]** button to begin input calibration.

When you click the **[Zero]** or **[Full Scale]** buttons of the Input Calibration section, you will be prompted to apply a specific voltage level at TB1 or TB2, according to your selected input range. Once you have applied this signal to the correct input terminals, click the **[OK]** button of the prompt and follow the on-screen instructions to complete input calibration.

Output…

Click the **[Output Cal Instructions]** button to begin output calibration. You will be prompted to adjust the input signal as required to drive the output to its precise output range zero or full-scale level. Then once the output is set to zero or full-scale, you simply click the corresponding **[Zero]** or **[Full-Scale]** button of the CALIBRATION - Output section to set the output range zero or full-scale endpoint.

Factory Settings (Use Only In Case of Trouble or for Sanitation Purposes)

- Restore a transmitter to its original factory calibration.
- Restore a transmitter to its initial factory configuration.

You can click the "Restore Factory" buttons if you ever misconfigure or miscalibrate a transmitter in such a way that its operation appears erratic, or for sanitation purposes when decommissioning a module.

Calibration Status (Bottom of Screen)

- Displays communication status messages for the calibration process.

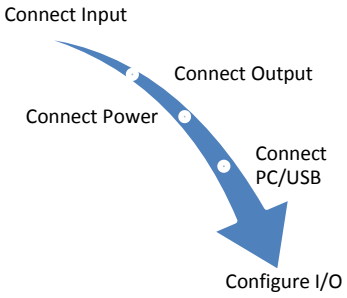
The CALIBRATION STATUS message bar at the bottom of the screen will display status messages relative to calibration.

TECHNICAL REFERENCE

OPERATION STEP-BY-STEP

Connections

This section will walk you through the Connection-Configuration-Calibration process step-by-step. But before you attempt to reconfigure or recalibrate this transmitter, please make the following electrical connections



Note: Your input source, output meter, and output load resistor (for current output) must be accurate beyond the unit specifications, or better than ±0.1%. A good rule of thumb is that your equipment source accuracy should be four times better than the rated accuracy you are trying to achieve with this transmitter.

Calibration Connections:

1. **Connect Input:** Connect a precision voltage source to the TB1 or TB2 input terminals according to your selected input voltage range and observe proper polarity. Use a voltage source with an output impedance of 100Ω or less.

2. **Connect Output:** Wire an output load to the unit appropriate for either current or voltage, as required by your application. You will need to measure the output current or voltage accurately in order to calibrate the unit. You could connect a current meter in series with the load to read the output current directly, or a digital volt meter in parallel with the load to measure output voltage. Alternatively, you could simply connect a voltmeter across a precision load resistor to accurately read output current as a function of the IR voltage drop produced in the load resistor (recommended for current outputs).

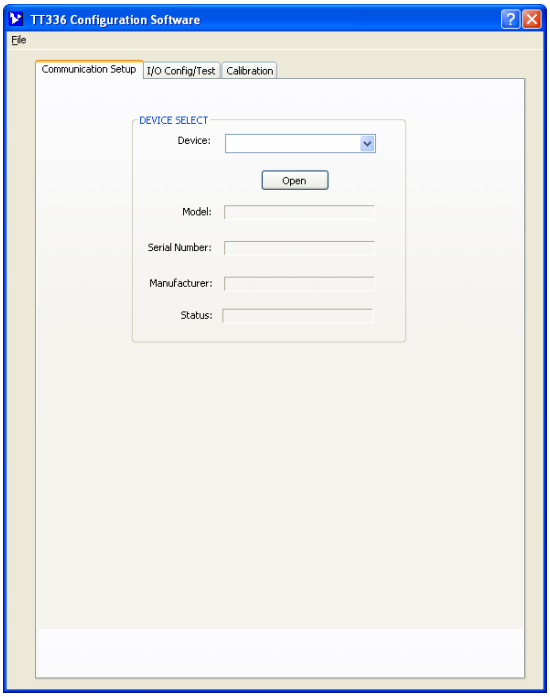
3. **Connect Power:** Wire 12-32VDC power to the unit at TB4 as shown in the Electrical Connections section. Optionally, you may wire power to the bus terminal as shown in the optional power connections drawing. But in either case, never exceed 36VDC peak, or damage to the unit may result.

   Apply power to the transmitter before connecting to USB. You will not be able to configure or calibrate the unit without power also applied, as this device does not use USB power.

4. **Connect to PC via USB:** Connect the transmitter to the PC using the USB isolator and cables provided in Configuration Kit TTC-SIP (refer to Electrical Connections section). You may omit the isolator if you are using a battery powered laptop PC to connect to the unit, or if your input source is not already grounded.

   Now that you have made your connections and applied power, you can execute the TT337Config.exe software to begin configuration of your unit (software is compatible with XP or later versions of the Windows operating system).

Configuration

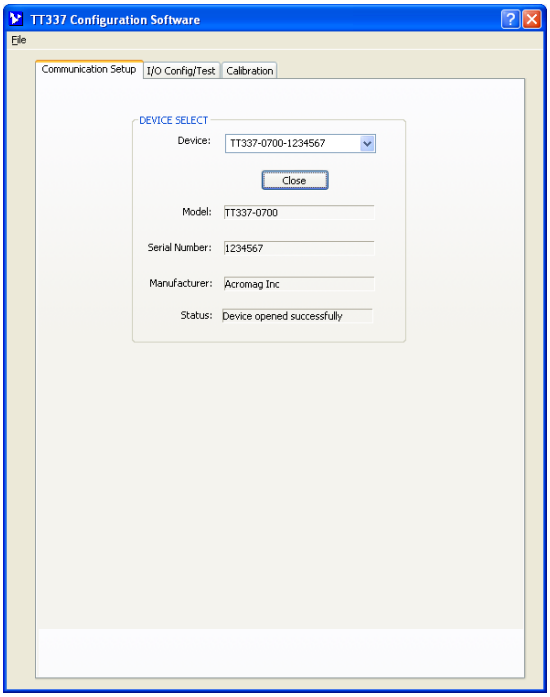


Note that you should already have power connected to the transmitter at this point. This model does not utilize USB power and you will not be able to configure, calibrate, or test the unit without power applied.

After executing the Acromag Configuration software for this model, the screen shown at left will appear, if you have not already connected to your transmitter via USB (note fields are blank under these conditions).

Connect your PC to the unit via USB, and the unit's model-serial information will appear in the Device field as shown in the second screen at left.

If you happen to be connected to more than one unit via a USB hub, you can use the Device scroll field to select another unit, using the serial information suffix of the Device Model number to discern one unit from another.

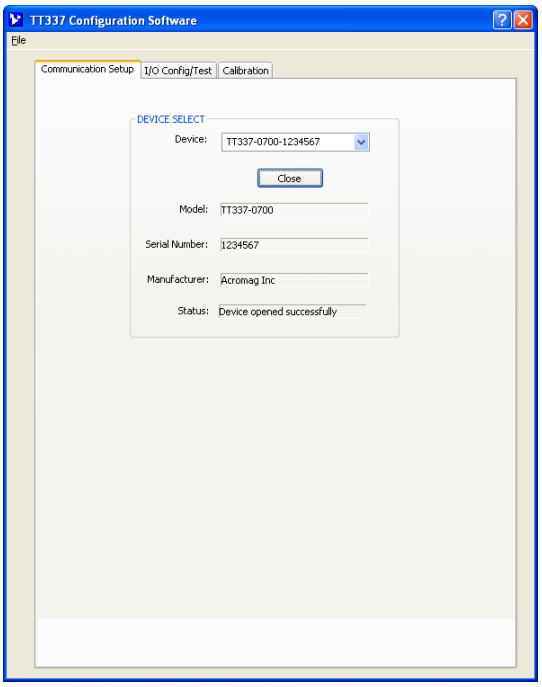


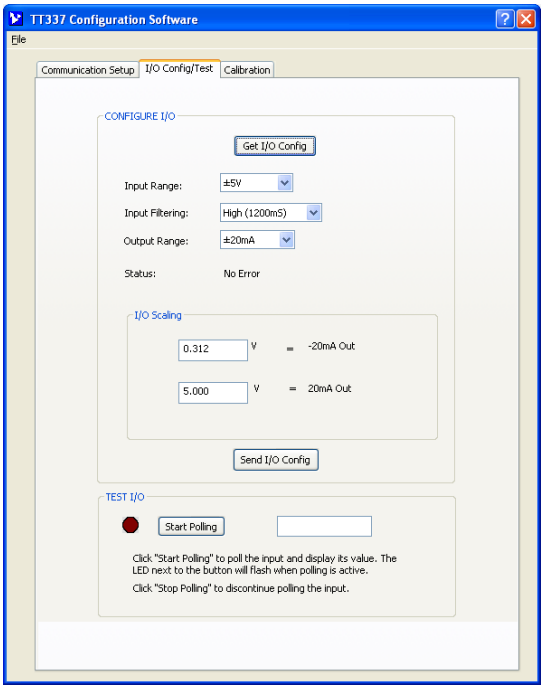
Once you have selected a device, click the **[Open]** button to open communication with the unit.

After clicking [Open], the selected unit's Model, Serial Number, Manufacturer, and connection status message will be displayed as shown in the first screen on the next page.

TIP: Always Close a connection with one device before selecting another device.

Configuration…





After you connect USB and "Open" communications with a unit, the Status field indicates "Device opened successfully" as shown in the screen at left. At this point, you can click the **"I/O Config/Test"** tab to begin configuring the unit, or to optionally test its operation. The I/O Config/Test screen is the second screen shown at bottom left.

When you click the "I/O Config/Test" tab, the software retrieves the unit's current configuration and displays it similar to the second screen shown at left.

IMPORTANT: This model has two inputs for voltage at different levels. The first input is for DC voltages up to +/-1V and its input is at TB1 (the upper terminal block). The second input is for DC voltages up to +/-10V and its input is at TB2 (the lower terminal block). Only one input may drive the output at one time. Your selected input range will determine which terminal block you wire your input to.

If you are connected to a module, the initial I/O Config screen represents the current configuration of the connected module before making changes. Otherwise, if you have loaded the configuration from a saved file, or if you have made changes to any fields, you can click the **[Get I/O Config]** button at the top of the screen to retrieve the connected module's current configuration.

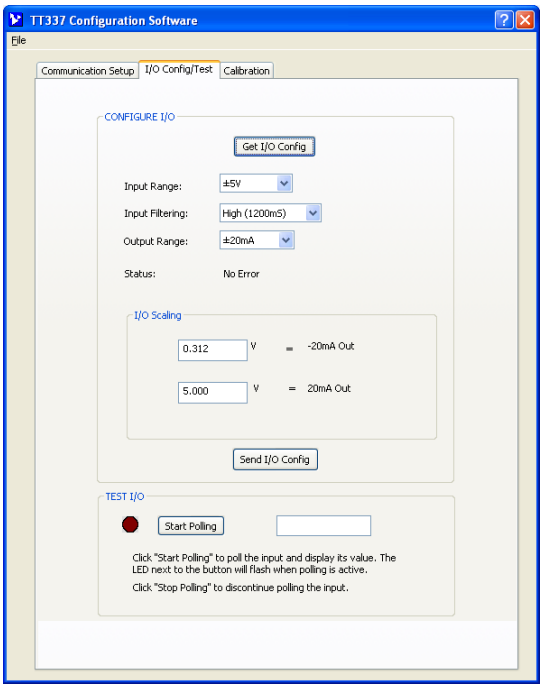
Note that if you make any changes to the selections indicated, the only way to preserve your changes is to write them to the device by clicking the **[Send I/O Config]** button after completing your selections, or to save them to a file by clicking **"File"** in the upper left-hand corner of the screen.

Select the Input Type/Range…

Input Type refers to the particular input range. If you are wired to TB1, you are limited to DC voltage ranges up to ±1V (-1V to +1V, and 0 to 1V). If you are wired to TB2, then you may select DC Voltage ranges up to ±10V (-10 to +10V, -5V to +5V, 0-5V, and 0-10V).

Note that any input range you pick can be rescaled to the output, allowing you to use only a portion of a selected input range to drive a current or voltage output, as desired. However, resolution will decrease proportionally as you rescale the input signal smaller than the nominal range. Each halving of the nominal range will reduce resolution by 1 bit. This can also magnify error, especially noticeable for very small input ranges which degrade the signal-to-noise ratio of the input and resolution of the analog-to-digital conversion. You should be cognizant of your range maximum and wire it to the appropriate input as well, as ranges smaller than ±1V should not be wired to TB2, which is intended for ranges above ±1V up to ±10V.

Configuration…



HELP – You can press **[F1]** for Help on a selected or highlighted field or control. You can also click the **[?]** button in the upper-right hand corner of the screen and click to point to a field or control to get a Help message pertaining to the item you pointed to.

Select the Input Filtering…

You may select the level of digital filtering to apply to the input channel as Low, Medium, High, or None (No digital filtering). The respective I/O response times are indicated in parenthesis next to your filter selection. Note that higher filter levels result in lower average noise, but with slower I/O response times.

Select the Output Range…

The output terminals of this unit are universal and may drive DC current or voltage in the ranges ±20mA, 0-20mA, 4-20mA, ±10V, ±5V, 0-10V, and 0-5V. Voltage outputs may drive 1KΩ or higher loads, while current outputs may drive 525Ω or less.

Select the Input/Output Scaling…

You may rescale selected input ranges to use only a portion of the input range to drive the output if desired. Be careful not to reduce the input range too much, as resolution will be proportionally diminished and noise/error magnified.

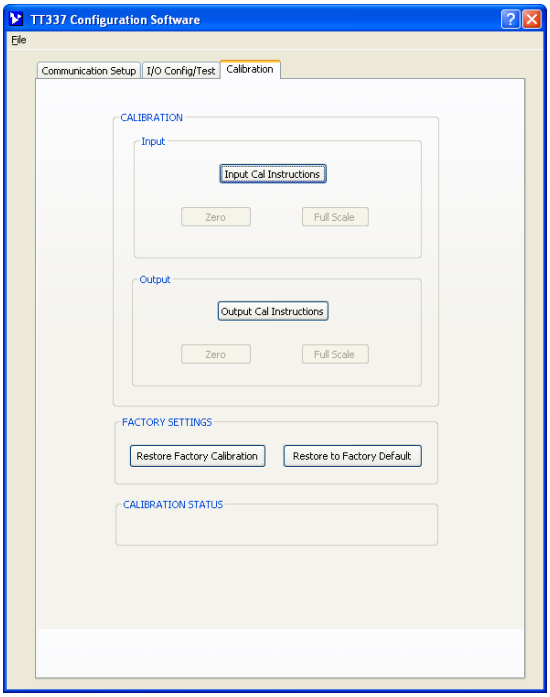
In the corresponding I/O Scaling field, set the input signal minimum/zero value to correspond to the output range zero value (i.e. -20mA, 0mA, 4mA, -5V, -10V, or 0V, depending on the output range selected). Also set the input signal maximum/full-scale value to correspond to the output range full-scale (i.e. 20mA, 10V, or 5V, depending on output range selected). You can optionally swap scaling levels to configure a reverse acting output response if desired. Note that approximately 5% of under and over-range is built into each output range selection.

If the scaled input zero and full-scale points are chosen too close together, performance will be degraded.

Once you have made your configuration selections, click the **[Send I/O Config]** button to write them to the module. You can read the Status of your sent message to the unit in the "Status" field. Alternately, you could click **"File"** in the upper left hand corner to save the settings to a file on your PC, for later reference.

At this point, you can test the module's operation by clicking on the **[Start Polling]** button of the TEST I/O section of the I/O Config/Test page to trigger the software to periodically read the input and display its value in the field to the right of the polling toggle button. Note the simulated lamp next to the button flashes slowly each time it samples the input. Click **[Stop Polling]** to stop polling the input before moving onto the next page.

Calibration (Optional)



CAUTION-Input Calibration: Driving input levels outside of the nominal input range of the unit will not be acceptable for calibration of zero or full-scale. Since input levels cannot be validated during field calibration, incorrect signal levels will produce an undesired output response.

Once you've configured your unit, you are ready to install it in the field, as the unit has already been factory calibrated. If you later encounter error that is out of specification, you can choose to click the **Calibration** tab to display the Calibration control page shown at left.

IMPORTANT: This unit has already had its input and output channels factory calibrated with a high level of precision. If you attempt to recalibrate the input or output channel, you could degrade its performance if it is not done properly, or it is done using lower grade equipment. Consider your decision to recalibrate carefully.

Calibration of this model is a simple two-part process initiated by simply clicking the Input Cal or Output Cal **"Instructions"** button to begin, then follow the on-screen prompts.

CALIBRATION – Input

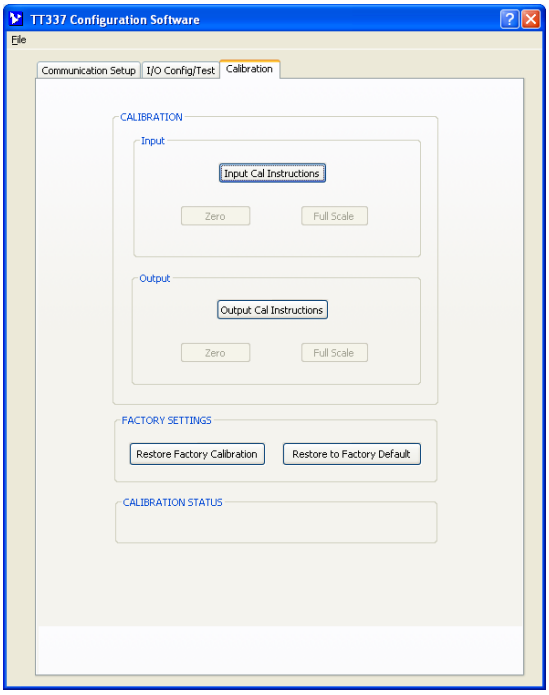
*Before attempting to recalibrate the input channel, first set the Input Range to select the input to calibrate on the "I/O Config/Test" page. Additionally, make sure you write your selection to the unit by clicking the **[Send I/O Config]** button.*

After setting your input range, click the "Input Cal Instructions" button to begin input calibration and enable the Input [Zero] and [Full-Scale] buttons.

Click the Input **[Zero]** button and you will be prompted to input the minimum value of your selected input range at the appropriate input channel. If you are wired to TB1, this will be -1V or 0V for ±1V and 0-1V input ranges. If you are wired to TB2, this will be -10V, -5V, or 0V, for the ±10V, ±5V, 0-5V, and 0-10V input ranges. Note that the software does not use your scaled range zero, but the nominal zero of the input type/range you selected. Once you input the zero precisely, follow the on-screen prompt and click the **[OK]** button to calibrate zero.

Click the Input **[Full-Scale]** button and you will be prompted to input the maximum value of your selected input range at the appropriate input channel. Depending on input type/range, this will be 1V, 5V, or 10V. The software does not use your scaled full-scale, but the nominal full-scale of the input type/range. Once you input full-scale precisely, follow the on-screen prompts and click the **[OK]** button to calibrate full-scale.

Calibration…



CALIBRATION – Output

Click the **[Output Cal Instructions]** button to begin output calibration and enable the Output [Zero] and [Full-Scale] buttons.

First adjust the input signal as necessary to drive the output signal to precisely the zero of your selected output range (i.e. -20.000mA, 0mA, 4.000mA, -10V, -5V, or 0V, depending on your output range setting). Be sure to measure this output level accurately, or performance will be degraded. After driving the output to its precise output range zero, click the Output **[Zero]** button of the Calibration Output section to calibrate the output zero signal level.

Next adjust the input signal as necessary to drive the output signal to precisely the full-scale of your selected output range (i.e. 20.000mA, 5V, or 10V, according to your output range setting). Be sure to measure this output level accurately, or performance will be degraded. After driving the output to precisely full-scale for the output range, click the Output **[Full-Scale]** button of the Calibration Output section to calibrate the output full-scale signal level.

If your output acts erratic or appears imprecise, you may need to repeat input or output calibration, being very careful to take accurate measurements and input correct signal levels. For current outputs, if you are measuring a voltage across an output load resistance, make sure that you use the exact load resistance when calculating the load current being measured. Also when rescaling your input to a smaller sub-range, make sure that you still have adequate input span, as too-tight input spans have diminished resolution and will magnify error.

Factory Settings

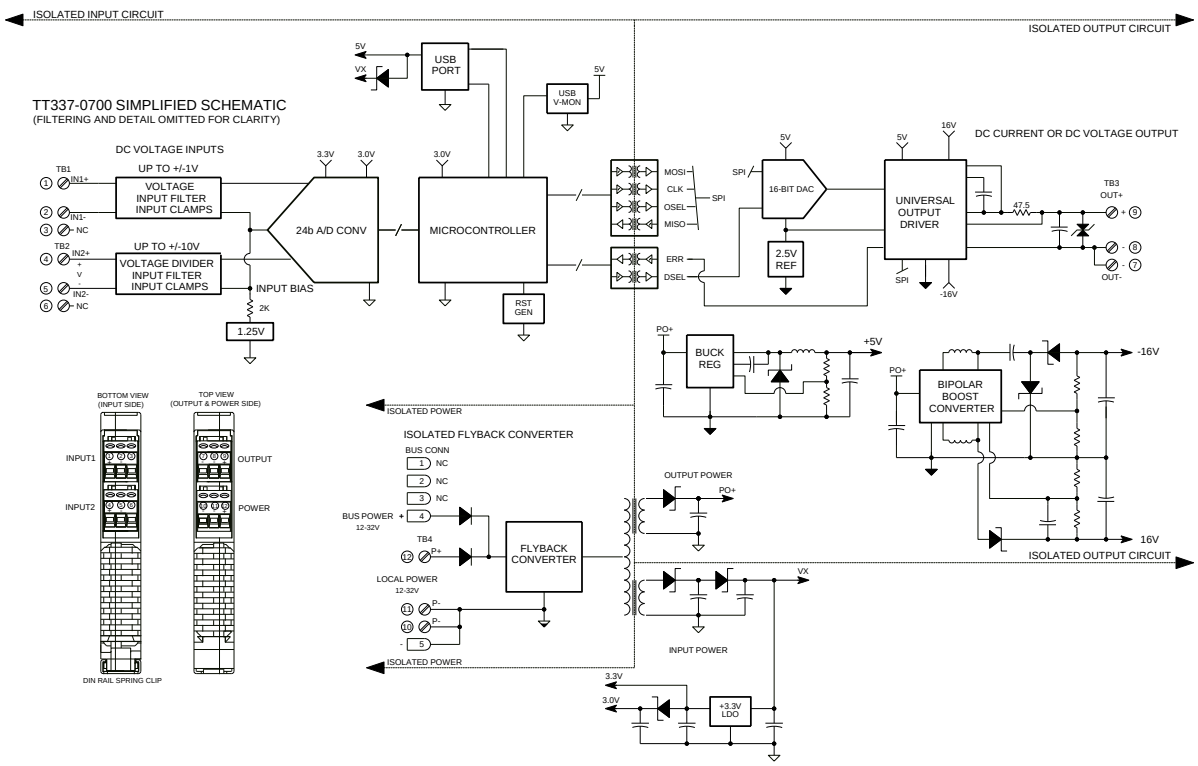
You can use the **[Restore Factory Calibration]** button to restore the transmitter's original factory calibration if you think you made an error during recalibration, degraded its performance, or the I/O channel appears erratic.

You can use the **[Restore to Factory Default]** button to return the unit to its original factory state configuration settings. This does not restore calibration, only configuration. Alternately, this button can be used as a sanitation tool to restore the unit to its initial configuration when decommissioning a module.

Calibration Status

This field displays calibration status messages like "No Error", "Transfer Error", and "Timeout Error" during calibration. If you encounter a Transfer or Timeout Error, you may have to repeat the calibration process.

BLOCK DIAGRAM



How It Works

Key Points of Operation

- Unit is DC Powered
- Power is Isolated
- Input is Isolated
- Input is Differential Voltage
- Input circuit ground is common to USB ground.
- Output is universal, current or voltage.

This transmitter uses a 32-bit microcontroller and a high-resolution 24-bit A/D to digitize the input signal and communicate to the output DAC via an SPI bus, isolated via digital isolators. This signal is transmitted to a 16-bit output DAC which drives a universal output driver for current or voltage. The output is very unique in that it may drive current or voltage to the load without having to change connections (only the load resistance must be adjusted). The output range is user-configured via the isolated SPI bus. Power for the isolated input and isolated output circuits is provided via an isolated fly-back converter that operates on voltage wired to the power terminals at TB4, or wired to optional bus power terminals along the DIN rail. Setup involves selecting the input range, selecting the output range (current or voltage), selecting a filter level, and scaling your input range endpoints to the output range zero/full-scale endpoints. I/O scaling can also be done in reverse to produce a reverse acting output signal. Refer to the block diagram above to gain a better understanding of how this transmitter works.

The input/USB, output, and power circuits are all isolated from each other. This unit does not draw power from USB and the USB port ground is common to the input circuit ground. The USB port ground of most PC's is also common to the USB cable shield and earth ground. Input sensors could be grounded or ungrounded. For this reason, it is recommended that USB signals be isolated when connected to a PC to prevent a ground loop from occurring between the PC earth ground and a grounded input sensor, which would have the negative effect of pulling the input bias supply to ground and clipping any negative range.

TROUBLESHOOTING

Diagnostics Table

Before attempting repair or replacement, be sure that all installation and configuration procedures have been followed and that the unit is wired properly. Verify that power is applied to the unit and that your supply voltage is at least 12V.Verify that your load resistance is appropriate to your output type, current or voltage.

If your problem still exists after checking your wiring and reviewing this information, or if other evidence points to another problem with the unit, an effective and convenient fault diagnosis method is to exchange the questionable unit with a known good unit.

Acromag's Application Engineers can provide further technical assistance if required. Repair services are also available from Acromag.

POSSIBLE CAUSE	POSSIBLE FIX
Cannot Communicate with Transmitter via USB…	
Output shifts off-range when you connect USB…	
Output Erratic, Not operational, or at Wrong Value…	
Unit fails to operate or exhibits an output shift…	
A missing USB Isolator could cause a ground loop between a grounded input and earth ground at the connected Personal Computer's USB port.	Without USB isolation, a ground loop is possible between a grounded input signal and earth ground of the PC USB port. The input of this model is normally biased to 1.25V off input ground to process negative-going signals. A grounded signal source could inadvertently short this bias to earth ground and clip the negative input range with a non-isolated USB connection to a PC. For this reason and for increased safety and noise immunity, it is best to connect to USB via a USB isolator. Use an isolator like the Acromag USB-ISOLATOR. Otherwise, use a battery powered laptop to configure the transmitter, which does not normally earth ground its USB port.
Software Fails to Detect Transmitter…	
Bad USB Connection	Recheck USB Cable Connection.
USB has not enumerated the device.	Use the reset button on the Acromag USB isolator to trigger renumeration of the transmitter, or simply unplug and re-plug the USB cable to the transmitter.
Communication or power was interrupted while USB was connected with configuration software running.	Close the current connection with the software, then select and re-open the transmitter for communication (or simply exit the Configuration software and reboot it).
For an input step, the output appears to make 2 steps to reach its final value…	
For a step change in the input, the A/D needs 2 input samples to charge to its final level.	When you step the input signal, it takes two samples for the A/D to charge up to its final output level, and this is evident when using a scope to examine the output transition in response to a step change at the input, which appears to make two steps in its transition to its final level.

Diagnostics Table…

POSSIBLE CAUSE	POSSIBLE FIX
Output goes right to Over-Range (~105%) or Under-Range Limit…	
This indicates that either the input signal is out of range, or a sensor lead has broken. It can also occur due to contention between earth ground at the PC USB port and the input sensor.	Check the input signal with respect to its range and reduce or increase it as required to drive the output within its linear operating range. A fully upscale or down-scale signal can be driven by a sensor fault, such as an open or broken sensor lead. Also check the wiring of your input sensor. If you are not isolating USB, check for a ground loop between a grounded sensor and earth ground of the PC USB port.
Cannot Calibrate Input Channel…	
Is input wired properly?	Check that input is wired to ± input terminals using correct polarity.
Cannot Measure Input Voltage…	
Have you wired the input to the correct terminals for the range selection?	DC Voltage up to ±1V is input to TB1 (upper block), while DC voltage above ±1V and up to ±10V is input to TB2 (lower block).
Output Noise/Error Seems Excessive…	
Scaled input range is too small.	Scaling the input to very small spans diminishes input resolution and signal to noise ratio, potentially magnifying error. Increase the scaled input span.

Service & Repair Assistance

This unit contains solid-state components and requires no maintenance, except for periodic cleaning and transmitter calibration and verification (zero and full-scale). Its enclosure is not meant to be opened for access and can be damaged easily if snapped apart. It is highly recommended that a non-functioning transmitter be returned to Acromag for repair or replacement. Acromag has automated test equipment that thoroughly checks and calibrates the performance of each transmitter, and can restore firmware. Please refer to Acromag's Service Policy and Warranty Bulletins, or contact Acromag for complete details on how to obtain repair or replacement.

ACCESSORIES

Software Interface Package

Software Interface Package/Configuration Kit – Order TTC-SIP

- USB Signal Isolator
- USB A-B Cable 4001-112
- USB A-mini B Cable 4001-113
- Configuration Software CDROM 5040-944

This kit contains all the essential elements for configuring TT family Transmitters. Isolation is recommended for USB port connections to these transmitters and will block a potential ground loop between your PC and a grounded input. A software CDROM is included that contains the Windows software used to program TT transmitters.

USB Isolator

USB Isolator – Order USB-ISOLATOR

- USB Signal Isolator
- USB A-B Cable 4001-112
- Instructions 8500-900

This kit contains a USB isolator and a 1M USB A-B cable for connection to a PC. This isolator and cable are also included in TTC-SIP (see above).

USB A-B Cable

USB A-B Cable – Order 4001-112

USB A-B Cable 4001-112

This is a 1 meter, USB A-B replacement cable for connection between your PC and the USB isolator. It is normally included with the TTC-SIP Software Interface Package and also with the isolator model USB-ISOLATOR.

USB A-mini B Cable

USB A-mini B Cable – Order 4001-113

- USB A-mini B Cable 4001-113

This is a 1 meter, USB A-miniB replacement cable for connection between the USB isolator and the TT230 transmitter. It is normally included in TTC-SIP.

Note that software for all TT Series models is available free of charge, online at www.acromag.com.

SPECIFICATIONS

Model Number

Model TT337-0700

Signal Transmitter
Isolated DC Voltage Input
Four-Wire Powered
CE Approved
Includes UL/cUL Class 1, Division 2 approvals

Custom calibration to your specifications can be added as a separate line item at time of purchase.

The TT337 model prefix denotes a DC voltage input type of the DIN-Rail Mounted Series TT "Thin Transmitter" family. The trailing "-0700" model suffix denotes 4-wire power with CE and UL/cUL Class 1, Division 2 Approvals included.

Optional factory calibration to your own specification is ordered as a separate line item at time of purchase, and on a per unit basis. Factory calibration will require the specification of nominal input range, output range, scaled input range zero, and scaled input range full-scale. You can also specify a normal or reverse acting output and a filter level. You can obtain form 8500-858 for specifying this calibration info from our web site at www.acromag.com.

The standard model without adding custom factory calibration is calibrated by default to reference test conditions for ±1V DC (TB1) and ±10V DC (TB2), mapped to 4 to 20mA at the output, a medium filter selection, and a normal acting output.

Recalibration of any model will require use of the TTC-SIP configuration kit, ordered separately (see Accessories section).

Models can be mounted on standard 35mm "T" Type DIN rail.

Input

This model has two separate inputs for DC voltage, but only one input can drive the output at one time. Up to ±1V is input at TB1 terminals, and up to ±10V at TB2 terminals.

Input Reference Test Conditions: ±1V input at TB1, or ±10V input at TB2; 25°C ambient; 24V DC Supply.
DC Voltage (±1V MAX at TB1, ±10V MAX at TB2): Configurable for ±1V, 0-1V, ±10V, ±5V, 0-10V, and 0-5V DC nominal input ranges. Nominal inputs may be rescaled to drive the output using only a portion of the input range. The input voltage is processed differentially by the A/D converter. There are two separate input points, but only one input may drive the output at a time.
Input Impedance: 15MΩ minimum at TB1 (no resistor divider), and 1084.6KΩ at TB2 (a 12.5:1 resistive divider is present at TB2).
Input Overvoltage Protection: Bipolar Transient Voltage Suppressers (TVS) rated to 14V working, and 18V clamp level typical. Also includes differential input diode clamping, capacitive filtering, and series resistance.
Analog to Digital Converter (A/D): Input utilizes a 24-bit, Σ-Δ A/D converter, with only the first 16-bits used. Its signal is then normalized to a bipolar range count of ±25000 to simplify I/O scaling (see Resolution below).
Sampling Rate (A/D): Input is sampled at a variable rate according to the input filter selection as follows:

A/D SAMPLING RATE (SAMPLES/SECOND) PER INPUT FILTER			
NONE	**LOW**	**MED**	**HIGH**
214.65sps	53.6625sps	13.42sps	1.6775sps

Input Filter: Normal mode RC filtering, plus digital filtering, optimized and fixed per input range and filter selection within the Σ-Δ ADC. See Normal Mode Noise Rejection and Output Response Time.

Input…

Noise Rejection (Common Mode): Varies with input and input filter selection between 85dB (no filter) and 118dB (high filter), typical, with 100Ω input unbalance.
Noise Rejection (Normal Mode): Varies with input and input filter selection. Table below indicates the typical rejection at 60Hz for each input and input filter selection. Note that at the medium and high input filter settings, the A/D converter adds 80dB minimum of rejection for frequencies between 49Hz and 61Hz.

	TYPICAL 60Hz REJECTION PER INPUT & INPUT FILTER			
INPUT RANGE	**NONE**	**LOW**	**MED**	**HIGH**
TB1 (±1V)	1.1dB	11dB	> 80dB	> 80dB
TB2 (±10V, ±5V)	21dB	37dB	> 80dB	> 80dB

Input Resolution: The A/D of this model divides the input signal range into a number of parts that can be calculated by subtraction using the expression for A/D counts as (Vin*Gain/1.25)*32768+32768, with Gain=1 for all input ranges. Vin is the DC input voltage of this model after the resistive divider (TB2 divider is 86.6K/1084.6K, no divider at TB1). The resultant A/D count is then normalized using a bipolar conversion scheme of ±25000 corresponding to ±100% of input range. That is, -100%, 0% and +100% are represented by decimal values –25000, 0, and 25000, respectively. The effective input resolution for a given range will be the lowest resolution of either the A/D conversion, or its normalized value. An indication of nominal input resolution is expressed as the number of parts between the input range low and high endpoints shown in Table 1 (the shaded value is the effective resolution of the input for its nominal range, and is the lowest of the A/D resolution or its normalized value).

Table 1: Input Resolution Per Nominal Input Type/Range		
In Type/Range	**A/D Input Resolution**	**Normalized Input Resolution**
-1V to +1V DC[1]	1 part in 52428	**1 part in 50000**
0 to 1 DC[1]	1 part in 26214	**1 part in 25000**
-10V to +10V DC[2]	**1 part in 41862**	1 part in 50000
-5V to +5V DC[2]	**1 part in 20930**	1 part in 50000
0-10V DC[2]	**1 part in 20931**	1 part in 25000
0 to 5V DC[2]	**1 part in 10465**	1 part in 25000

[1] These ranges apply to signals wired to TB1 (no resistive divider).
[2] These ranges apply to signals wired to TB2 (86.6K/1084.6K resistive divider).

This unit allows a portion of the nominal input range to be rescaled to the output range selected. However, your effective input resolution will be proportionally diminished as you reduce the input range span below its nominal span. The effective I/O resolution of this transmitter will be the lowest resolution of either the A/D itself, or its normalized result, or the output DAC. In most cases it is dominated by the input resolution as the minimum output resolution is greater at 1 part in 46877 for 4-20mA out.

Output

Output Range Selection: Unit can be configured for one of six nominal output ranges shown below. All output ranges include approximately 5% of over-range.

OUTPUT RANGE	OUTPUT RANGE w/ OVER-RANGE
-10V to +10V	-10.5V to +10.5V
-5V to +5V	-5.25V to +5.25V
0-10V	-0.5527V to +10.5V
0-5V	-0.27634V to +5.25V
±20mA	-21mA to +21mA
0-20mA	-1.1054mA to +21mA
4-20mA	-1.1054mA to +21mA

Accuracy: Accuracy is better than ±0.05% of span, typical (±0.1% maximum), for nominal input spans. This includes the effects of repeatability, terminal point conformity, and linearization, but does not include sensor error.
Note: Scaling smaller than nominal input ranges to the output can increase potential error as input resolution and the signal-to-noise ratio are diminished for very small input spans.
Output Load: Voltage output can drive loads down to 1KΩ minimum. Current output can drive 20mA DC into 0-525Ω.
Output Ripple: Less than ±0.1% of output span. Note (High Speed Acquisition): Additional filtering at the load is recommended for sensitive applications with high-speed acquisition rates. High frequency noise is often reduced or eliminated by placing a 0.1uF capacitor directly across the load. For excessive 60Hz supply ripple with current output, a 1uF or larger bulk capacitor is recommended at the load.
Output Ambient Temperature Drift: Includes the combined effects of zero and span drift over temperature and is better than ±80ppm/°C (±0.0080%/°C) over the ambient temperature range for reference test conditions (see Input Specifications).
Output Resolution: Output is driven by a 16-bit Voltage DAC, Maxim MAX5216GUA+, with a 2.5V reference, and driving a universal current/voltage output driver. Output resolution per output range is indicated below. The effective I/O resolution of the unit will be the lowest resolution of the input A/D, and the output D/A relative to the programmed I/O ranges. The result is normalized to a 16-bit integer in the range of ±25000 corresponding to ±100%.

OUTPUT RANGE	Output Resolution, 1lsb, % of Span
-10V to +10V	1 part in 62415, 320.439uV, 0.001602%
-5V to +5V (a sub-range of ±10V)	1 part in 31208, 320.439uV, 0.003204%
0-10V	1 part in 59293, 168.653uV, 0.001686%
0-5V	1 part in 59293, 84.326uV, 0.001686%
±20mA	1 part in 62415, 0.64088uA, 0.001602%
0-20mA	1 part in 59293, 0.33731uA, 0.001686%
4-20mA	1 part in 47434, 0.33731uA, 0.002108%

Output Response Time: Varies with input range and filter level for a step change in the input signal as follows:

TT337-0700	TYPICAL RESPONSE TIME PER INPUT FILTER			
INPUT RANGE	NONE	LOW	MED	HIGH
TB1 (Up to ±1V)	12ms	28ms	115ms	1116ms
TB2 (Up to ±10V)	78ms	98ms	208ms	1164ms

USB Interface

Unit includes a USB socket for temporary connection to a PC or laptop for the purpose of configuration and calibration. USB isolation is required when also connected to a grounded input sensor (see "IMPORTANT" note below). During reconfiguration and calibration, the transmitter receives power from its power connection (via DIN rail bus or power terminal TB4), not USB. As such, you must connect power to the unit when you connect USB.

CAUTION: Do not attempt to connect USB in a hazardous environment. Transmitter should be setup and configured in a safe environment only.

Data Rate: USB v1.1 full-speed only, at 12Mbps. Up to 32K commands per second. USB 2.0 compatible.

Transient Protection: Adds transient voltage protection on USB power & data lines.

Cable Length/Connection Distance: 5.0 meters maximum.

Driver: No special drivers required. Uses the built-in USB Human Interface Device (HID) drivers of the Windows Operating System (Windows XP or later versions only).

USB Connector: 5-pin, Mini USB B-type socket, Hirose UX60-MB-5S8.

PIN	DEFINITION
1	+5V Power (Transient Protected, but not used by this model)
2	Differential Data (+)
3	Differential Data (-)
4	NC – Not Connected
5[1]	Power Ground (Connects to Signal Ground via ferrite bead)
SHLD[1]	Signal Ground (Connects directly to Signal Ground)

[1]**Note:** Most Host Personal Computers (except battery powered laptops) will connect earth ground to the USB shield and signal ground.

IMPORTANT – USB Isolation is recommended: The input of this transmitter is isolated from its output and can be connected to grounded or un-grounded input sensors. However, the transmitter's input circuit ground is connected in common to the USB power/signal/shield ground. This will in-turn make a connection to earth ground at the PC when directly connected to the USB port of a Personal Computer without using an isolator. Failure to connect USB without isolation would short the 1.25V input bias supply to input ground if the sensor is also earth grounded. This will interfere with operation, truncate the negative input range, and possibly cause the output to shift. For this reason, USB isolation is strongly recommended when connecting to a PC. Otherwise, in the absence of USB isolation, and when connected to a grounded input sensor, a battery powered laptop could be used to connect to the unit, as the laptop does not normally connect to earth ground.

Power

Power Supply (Connect at TB4 or via DIN Rail Bus Terminal): 12-32V DC SELV (Safety Extra Low Voltage), 1.3W maximum. Observe proper polarity. Reverse voltage protection is included. Current draw varies with power voltage as follows (currents indicated assume a current output driving 21mA into a load).

VOLTAGE	TT337-0700 SUPPLY CURRENT
12V	97mA Typical / 107mA Max
15V	72mA Typical / 80mA Max
24V	48mA Typical / 53mA Max
32V	36mA Typical / 40mA Max

CAUTION: Do not exceed 36VDC peak to avoid damage to the unit. Terminal voltage at or above 12V minimum must be maintained across the unit during operation.
Power Supply Effect: Less than ±0.001% of output span effect per volt DC change.

Enclosure & Physical

General purpose plastic enclosure for mounting on 35mm "T-type" DIN rail.
Dimensions: Width = 17.5mm (0.69 inches), Length = 114.5mm (4.51 inches), Depth = 99.0mm (3.90 inches). Refer to Mechanical Dimensions drawing.
I/O Connectors: Removable plug-in type terminal blocks rated for 12A/250V; AWG #26-12, stranded or solid copper wire.
Program Connector: 5-pin, Mini USB B-type socket, Hirose UX60-MB-5S8.
Case Material: Self-extinguishing polyamide, UL94 V-0 rated, color light gray. General purpose NEMA Type 1 enclosure.
Circuit Board: Military grade fire-retardant epoxy glass per IPC-4101/98.
DIN-Rail Mounting: Unit is normally mounted to 35x15mm, T-type DIN rails. Refer to the DIN Rail Mounting & Removal section for more details.
Shipping Weight: 0.5 pounds (0.22 Kg) packed.

Environmental

These limits represent the minimum requirements of the applicable standard, but this product has typically been tested to comply with higher standards in some cases.
Operating Temperature: -40°C to +80°C (-40°F to +176°F).
Storage Temperature: -40°C to +85°C (-40°F to +185°F).
Relative Humidity: 5 to 95%, non-condensing.
Isolation: Input/USB, output, and power circuits are all isolated from each other for common-mode voltages up to 250VAC, or 354V DC off DC power ground, on a continuous basis (will withstand 1500VAC dielectric strength test for one minute without breakdown). Complies with test requirements of ANSI/ISA-82.01-1988 for voltage rating specified.
Installation Category: Suitable for installation in a Pollution Degree 2 environment with an Installation Category (Over-voltage Category) II rating per IEC 1010-1 (1990).

Environmental…

Shock & Vibration Immunity: Conforms to: IEC 60068-2-6: 10-500 Hz, 4G, 2 Hours/axis, for sinusoidal vibration ; IEC 60068-2-64: 10-500 Hz, 4G-rms, 2 Hours/axis , for random vibration, and IEC 60068-2-27: 25G, 11ms half-sine, 18 shocks at 6 orientations, for mechanical shock.

Electromagnetic Compatibility (EMC)

Minimum Immunity per BS EN 61000-6-1:

1) Electrostatic Discharge Immunity (ESD), per IEC 61000-4-2.
2) Radiated Field Immunity (RFI), per IEC 61000-4-3.
3) Electrical Fast Transient Immunity (EFT), per IEC 61000-4-4.
4) Surge Immunity, per IEC 61000-4-5.
5) Conducted RF Immunity (CRFI), per IEC 61000-4-6.

This is a Class B Product with Emissions per BS EN 61000-6-3:

1) Enclosure Port, per CISPR 16.
2) Low Voltage AC Mains Port, per CISPR 14, 16.
3) DC Power Port, per CISPR 16.
4) Telecom / Network Port, per CISPR 22.

Agency Approvals

Safety Approvals: UL Listed (USA & Canada). Hazardous Locations – Class I, Division 2, Groups A, B, C, D Hazardous Location or Nonhazardous Locations only. These devices are open-type devices that are to be installed in an enclosure suitable for the environment. Consult Factory.

Electromagnetic Compatibility (EMC): CE marked, per EMC Directive 2004/108/EC. Consult factory.

Reliability Prediction

Reliability Prediction

MTBF (Mean Time Between Failure): MTBF in hours using MIL-HDBK-217F, FN2. *Per MIL-HDBK-217, Ground Benign, Controlled, $G_B G_C$*

Temperature	MTBF (Hours)	MTBF (Years)	Failure Rate (FIT)
25°C	1,172,033 hrs	133.8 years	853
40°C	769,367 hrs	87.8 years	1,300

Configuration Controls

Software Configuration Only via USB

This transmitter drives an analog output current or voltage proportional to a sensor input based on the differential voltage measurement across the sensor (voltage input at TB1 or TB2). No switches or potentiometers are used to make adjustments to this transmitter. Its behavior as an isolated signal amplifier/ transducer is determined via programmed variables set using a temporary USB connection to a host computer or laptop running a Windows-compatible configuration software program specific to the transmitter model. This software provides the framework for digital control of all configuration and calibration parameters, and this information is stored in non-volatile memory.

Refer to Operation Step-By-Step in the Technical Reference section of this manual for detailed information on available software control of this model.

Revision History

The following table show the revision history for this document:

Release Date	Version	EGR/DOC	Description of Revision
19-DEC-12	A	JEB/KLK	Initial Acromag release.
26-JULY-13	B	CAP/ARP	Added UL Mark to this model (removed pending), refer to ECN #13G017 for additional information. Added note to USB connections drawing, refer to ECN #13F005 for additional information.
16-DEC-13	C	JEB/ARP	Updated MTBF Numbers. Removed P.O. Box from address.